POOL WATER TREATMENT
ADVISORY GROUP

# TECHNICAL NOTE

# 16 Atmospheric determination of chloramines

**January 2004**
**Atmospheric Determination of Chloramines in 6 Swimming Pool Halls located within the M25 Catchment Area -2004**

**1.0.0 INTRODUCTION**
1.0.1 Oakland Calvert Consultants Ltd were commissioned by the Pool Water Treatment Advisory Group to undertake measurements of chloramines concentrations in 6 swimming pool hall atmospheres from sites located within the M25 catchment area.

1.0.2 It was agreed that this work would be undertaken during the school half term week when bather loadings should be at their maximum.

1.0.3 Monitoring was undertaken by Janice Calvert MSc, C.Chem MRSC, MCIWEM, MILAM, A.Inst SRM accompanied by Dr Phil Penny (Amateur Swimming Association). Dr Penny undertook subjective assessment and swam at some of the locations to determine bather comfort.

**2.0.0 BACKGROUND INFORMATION**
2.0.1 Venues were chosen purely on the basis of where Leisure Management companies were agreeable to us undertaking the work rather than on the basis of any knowledge regarding the pool.

2.0.2 In many cases multiple pools were present in the pool hall and in total 13 pools were present in the 6 pool halls tested.

2.0.3 Water treatment of these pools varied and is detailed in the Table at 4.0.1.

2.0.4 The age of the pools varied widely, but older pools had at some stage undergone refurbishment and all pool halls were fitted with some form of mechanical ventilation system.

2.0.5 It was agreed that the pool hall atmosphere in each location would be monitored for a maximum of 3 hours.

2.0.6 In order to be able to compare the atmospheric chloramines measurements recorded to those present in the pool water, samples of pool water were taken from each pool hall at the commencement of the air monitoring and towards the end of the 3 hour monitoring period.

**3.0.0 METHODOLOGY**
3.0.1 Atmospheric chloramines were measured by aspiration of pool hall air through a series of dreschel bottles containing deionised water and a sodium hydroxide trap. Air flow was set at between 2.0 and 2.5 litres per minute.

3.0.2 Chlorine concentrations were measured using a combination of DPD No.1,2, and 3 tablets and ion chromatography.

3.0.3 Air was sampled at a height of 1.5 metres above the finished floor level.

**4.0.0 RESULTS**
4.0.1 The results obtained are tabulated here…

Location A (main and teaching pools; electrolytic chlorination) 0.27

Location B (main and teaching pools; calcium hypochlorite) 0.36

Location C (leisure and spa/teaching pools; electrolytic chlorination) 0.20

Location D (main and teaching pools; trichlor)

Location E (one main pool; trichlor) 0.18

Location F (main, teaching & fun pools; sodium hypochlorite+ozone) 0.17

4.0.2 For pools treated with Trichlor, higher pool water testing results were initially obtained for monochloramine and dichloramine content. This was due to breakthrough of chlorine, on standing, from the cyaniric acid ring giving false positive results, these results are shown in brackets within the table.
Monochloramine and dichloramine results were subsequently taken as instant readings for Trichlor pools.

4.0.3 Details of the Pool Hall ventilation systems are tabulated and attached.

**5.0.0 DISCUSSION**
5.0.1 On the whole the number of bathers using the pools at the time of sampling was much lower than expected for the half term period. In each case we were informed by the Centre Management that bather numbers were normally greater during term time.

5.0.2 In all but one case, pool staff were unaware of the operating
conditions/settings of the pool hall ventilation system and the majority of sites were unable to provide any detail. In the light of this, although not originally part of the work, the pool hall air temperature and relative humidity were measured by OCC after the first day of air sampling. Ranges obtained varied between 55.1% and 77% relative humidity and 24.3°C to 31.8°C air temperature.

5.0.3 It can be seen from the results obtained for nitrogen trichloride in the pool hall atmosphere that there is a correlation between subjective assessment of the irritancy of the pool hall atmosphere and trend of results.
As would be expected those having higher concentrations of nitrogen trichloride gave greater irritant effects.

5.0.4 Significantly higher monochloramine and dichloramine values were obtained in those pools considered to be irritant by subjective assessment (locations B & C).

5.0.5 None of the pool atmospheres measured gave concentrations of nitrogen trichloride in excess of 0.5mg/$m^3$. However it was noticeable that the two oldest pool locations, D & E, gave significantly better results than the newer installations. This may be in part due to higher pool hall ceilings and therefore greater pool hall volume. The best results were obtained in location F where the pool water treatment system for two of the three pools incorporated ozone. However, this conclusion may be influenced by the relative numbers of bathers using the pools at the time of sampling compared with some of the other pools. During our monitoring period the bather usage of the of the pools was in decreasing order:

Location C Heaviest usage

Location B

Location F

Location A

Location E

Location D Lowest usage

**6.0.0 CONCLUSIONS**
6.0.1 None of the pool hall atmospheres monitored gave nitrogen trichloride concentrations in excess of 0.5mg/$m^3$. However from the results obtained it is clear that under higher bather load conditions nitrogen trichloride concentrations in excess of 0.5mg/$m^3$ could be easily achieved in some pools.

6.0.2 The presence of significant concentrations of monochloramine and dichloramine may possibly be associated with the relative humidity and the carry over in the atmosphere within moisture droplets rather than present as gases.